LHRS Pion Rejector Calibration

➢ **Last time:**

- Cerenkov electron efficiency
- Cerenkov pion rejection efficiency

➢ **Todo:**

- Cerenkov detector efficiency
- Pion rejector electron efficiency
- Pion rejector pion rejection efficiency
- More study on pions

Last time

- **Cerenkov efficiency**:

- Select clean electron and pion sample from pion rejector.
- Check the survive number of electron and pion in Cerenkov.

❖ Detector efficiency:

survive electron/electron sample

❖ Electron accept efficiency (cut):

survive electron/electron sample

❖ Pion reject efficiency (cut):

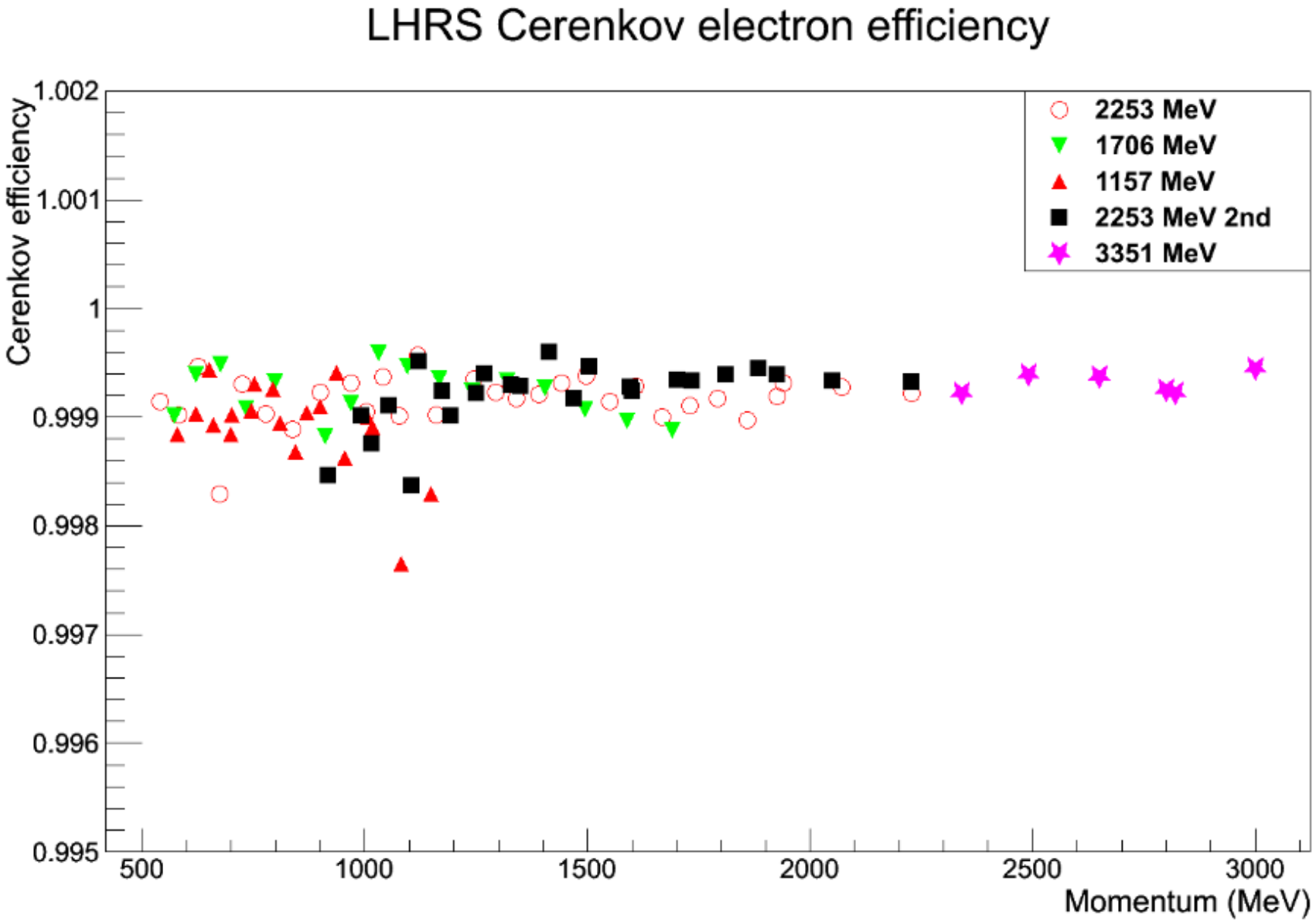
survive pion/pion sample

❖ Pion rejection factor:

- number of pion sample selected/(number of pion sample selected – number of pion survive)
- if pion rejection factor is 100, it means 100 pion sample, only 1 is mis-identified as electrons by the detector.

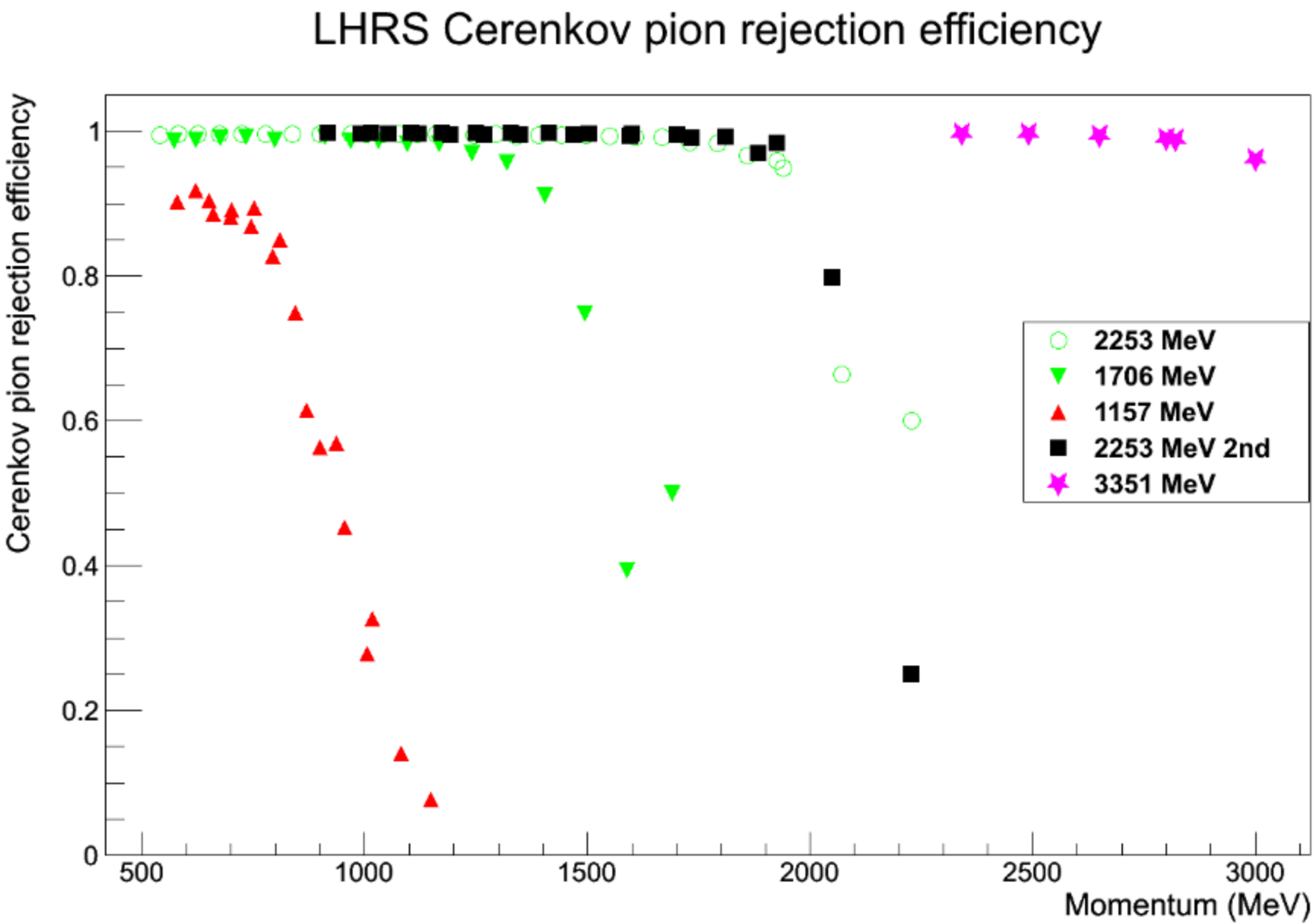
Last time

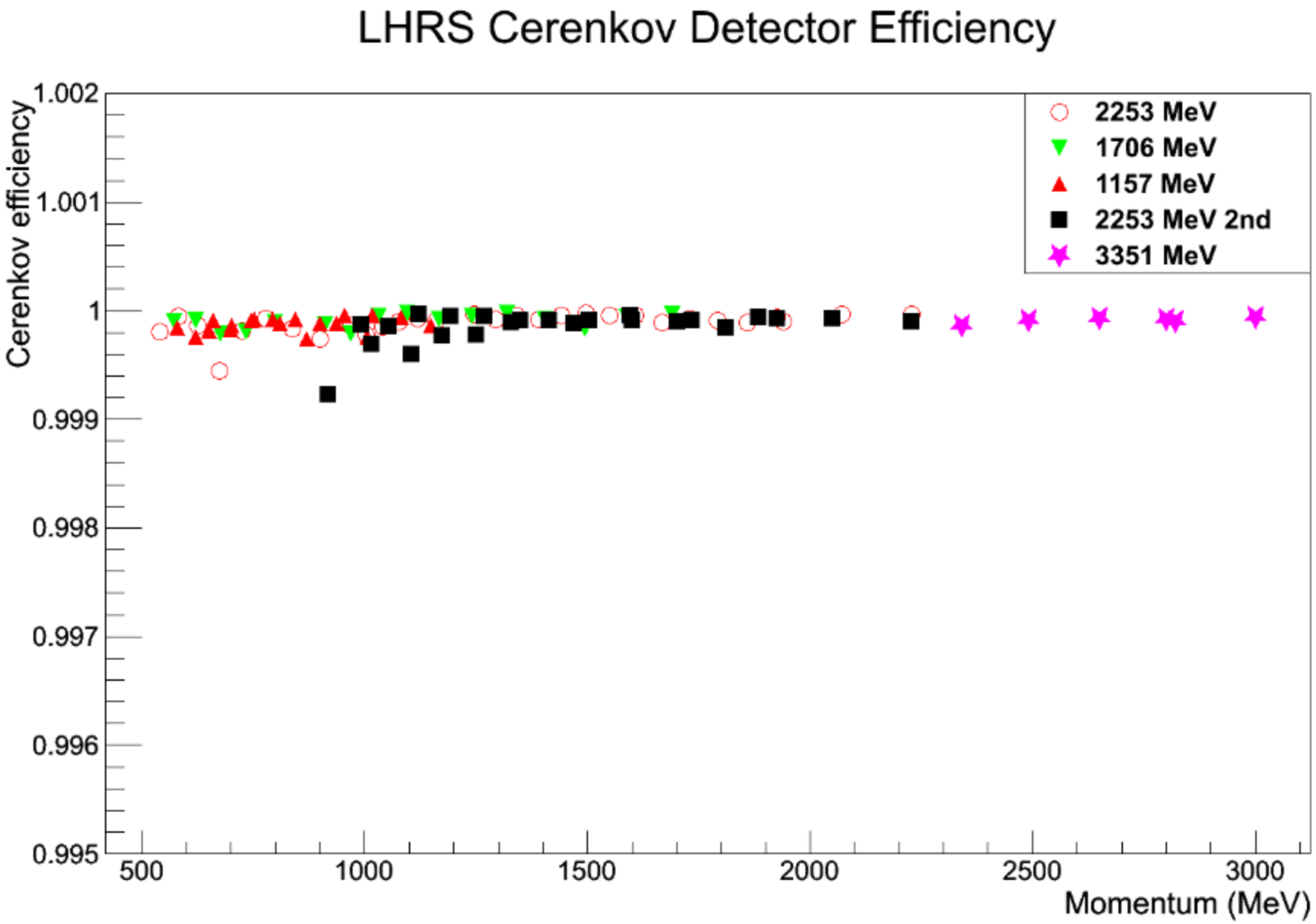
Cut: L.cer.asum_c>220



Last time

Cut: L.cer.asum_c<220





(no L.cer.asum_c cut applied in Cerenkov spectrum)

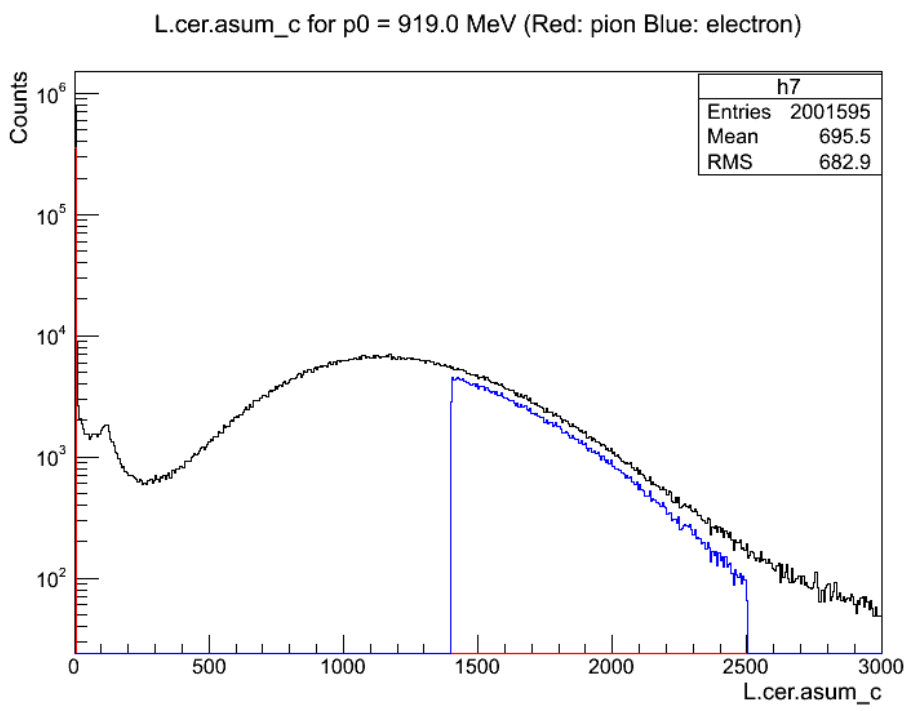
PID Efficiency study

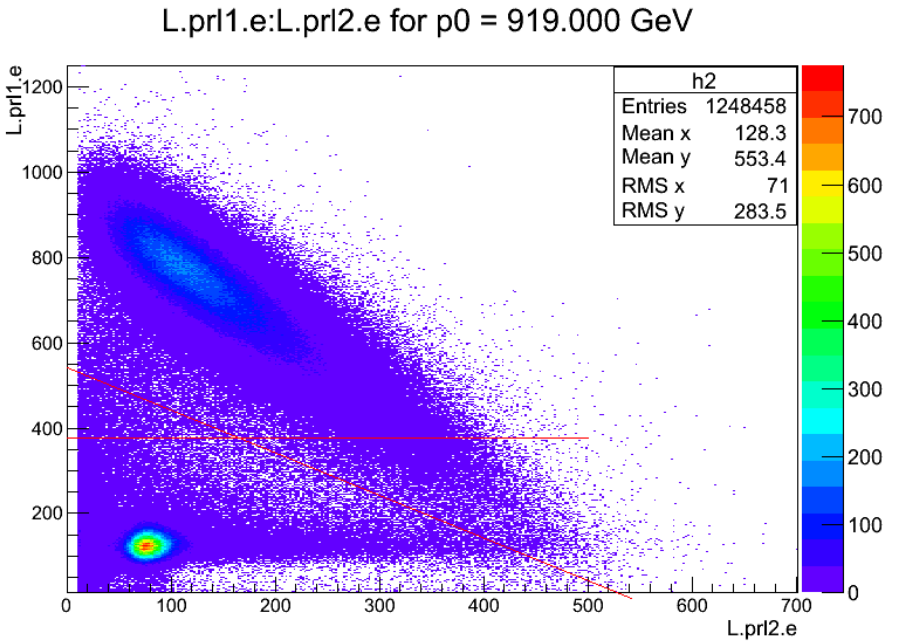
- **Pion Rejector efficiency**:
- Select clean electron and pion sample from Cerenkov.
- Check the survive number of electron and pion in pion rejector
- Detector efficiency:

  survive electron/electron sample
- Electron accept efficiency (cut):

  survive electron/electron sample
- Pion reject efficiency (cut):

  survive pion/pion sample
- Pion rejection factor:
- number of pion sample selected/(number of pion sample selected – number of pion survive)
- if pion rejection factor is 100, it means 100 pion sample, only 1 is mis-identified as electrons by the detector.





➢ **Sample selected:**

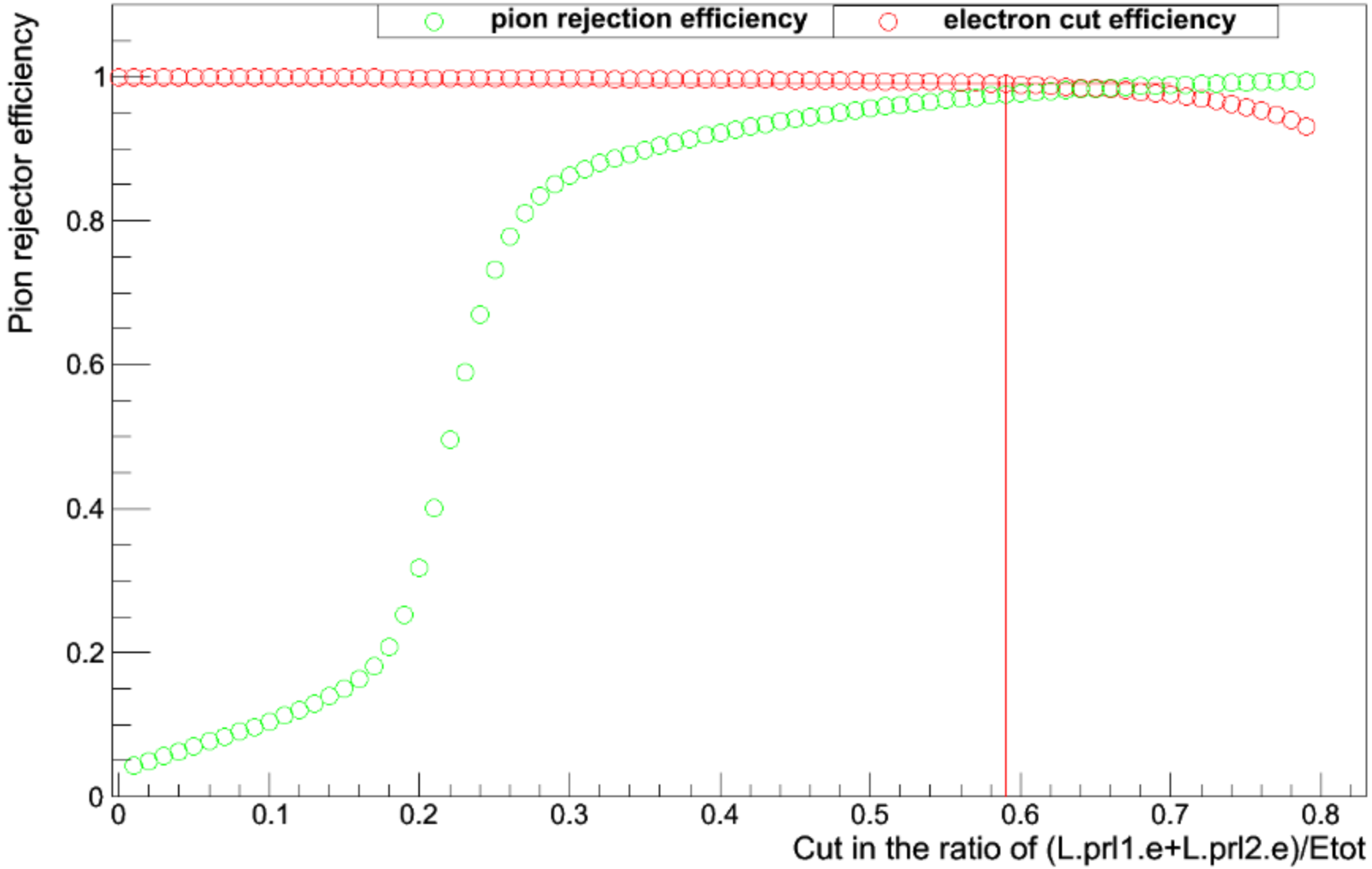
- Electron sample: Blue
- Pion sample : Red

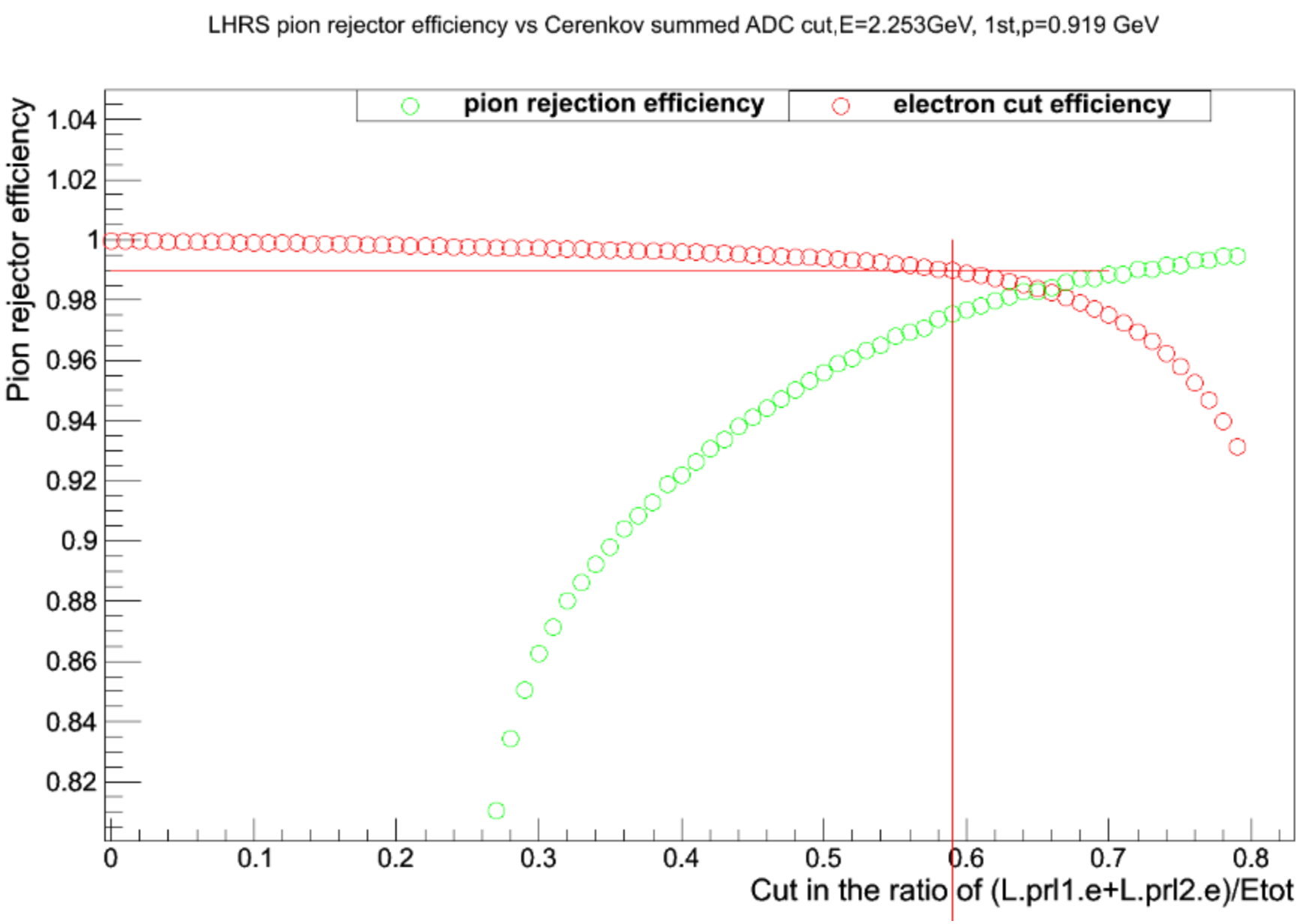
➢ **Detector Efficiency:**

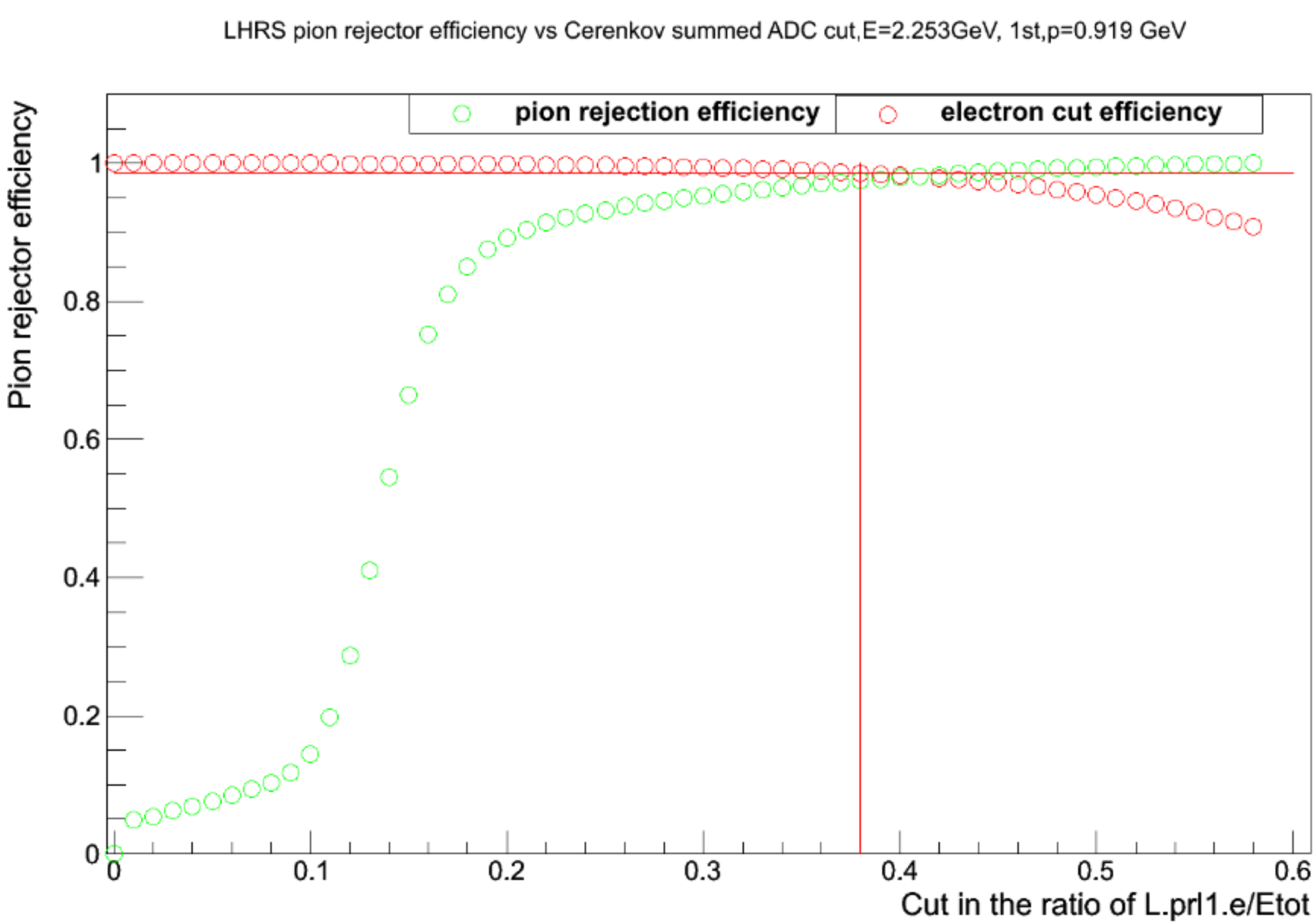
- Calculate the sample
- Calculate the sample trigger prl1 and prl2

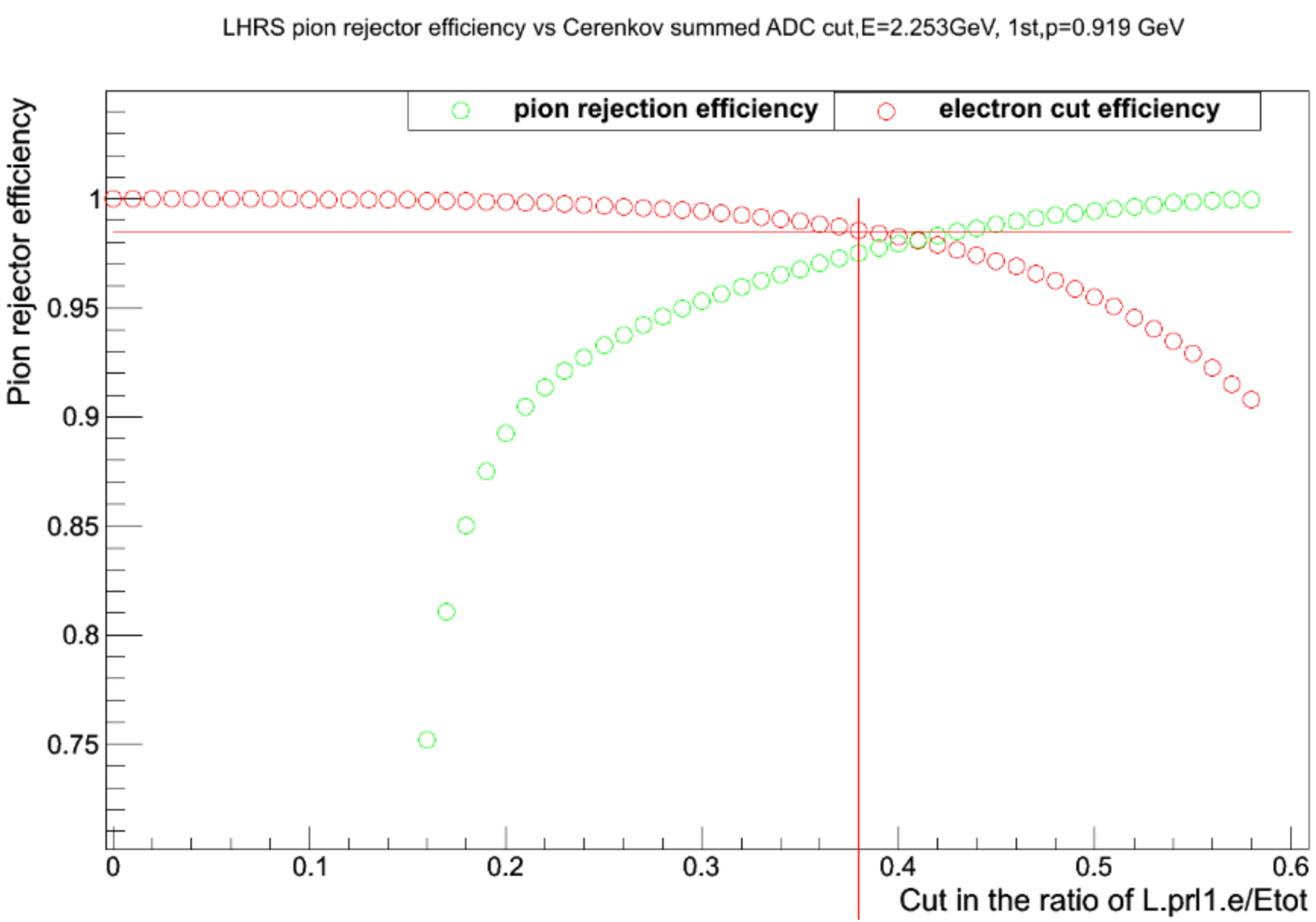
➢ **Cut Efficiency:**

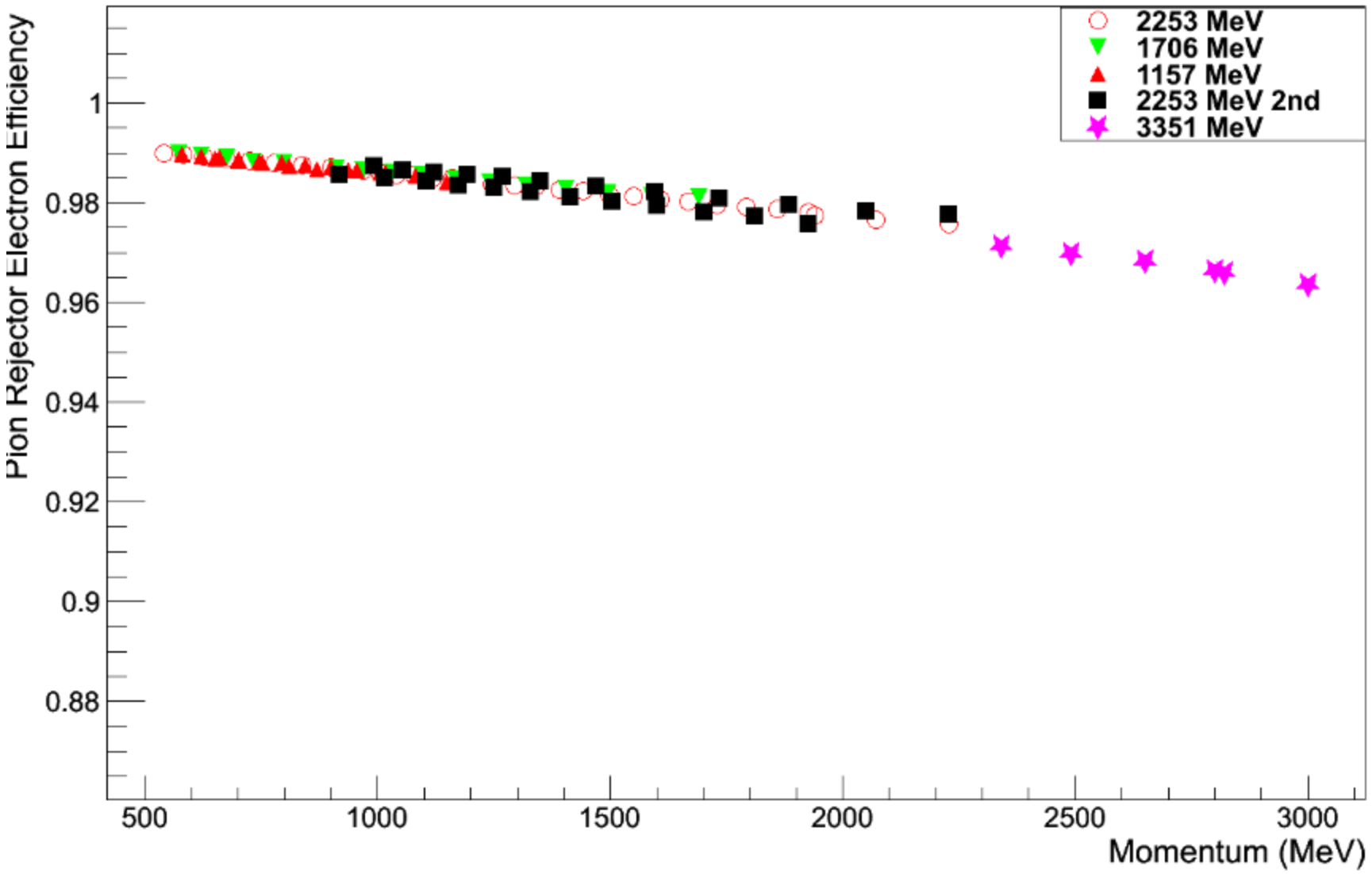
- Optimize the cut in prl1:prl2
  - ❖ Etot cut
  - ❖ Prl1 cut
- Calculated sample
- Calculate the sample trigger prl1 and prl2

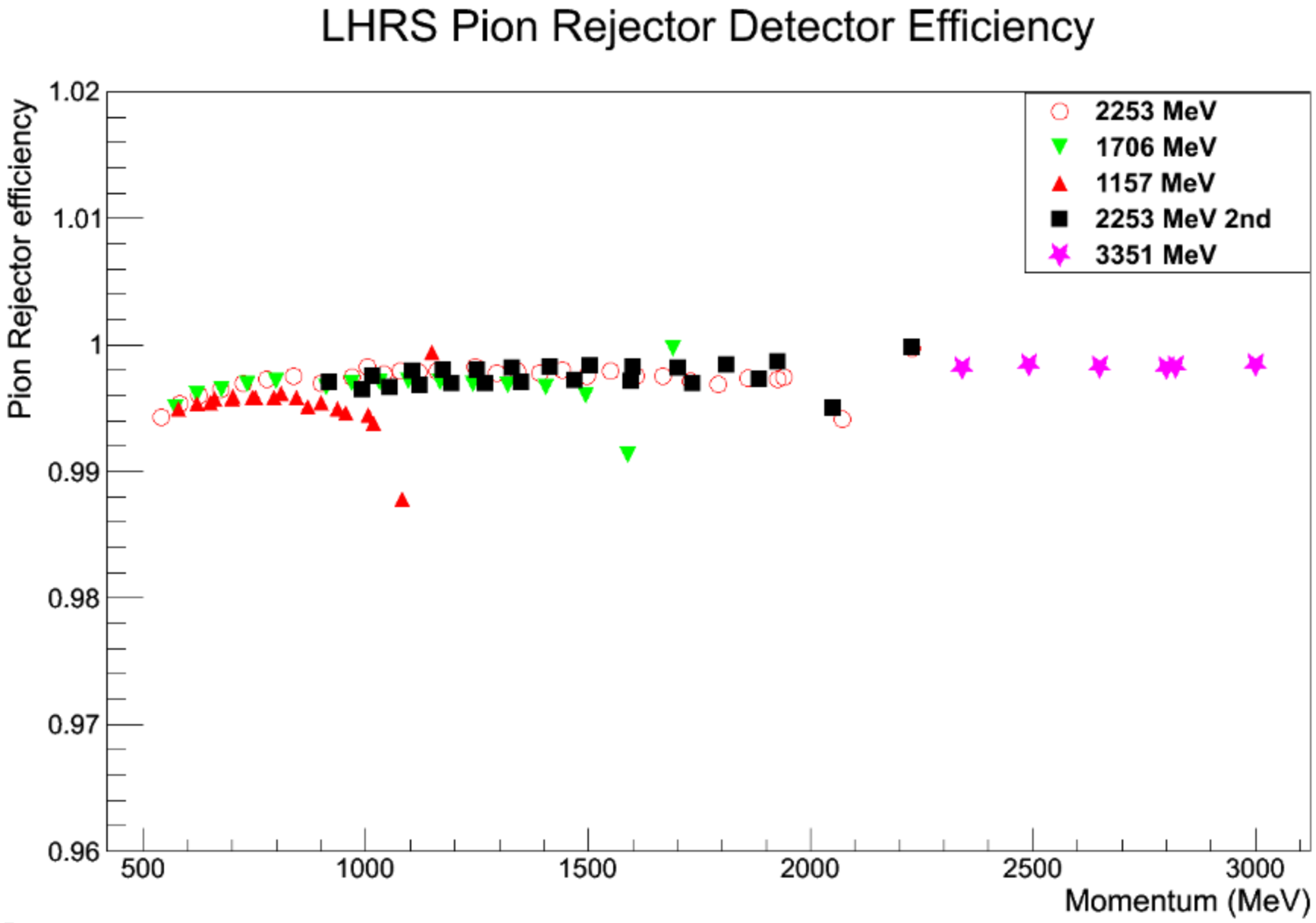

LHRS pion rejector efficiency vs Cerenkov summed ADC cut,E=2.253GeV, 1st,p=0.919 GeV
pion rejection efficiency
electron cut efficiency
Pion rejector efficiency
Cut in the ratio of (L.prl1.e+L.prl2.e)/Etot
0
0.2
0.4
0.6
0.8
1
0.1
0.3
0.5
0.7


LHRS pion rejector efficiency vs Cerenkov summed ADC cut,E=2.253GeV, 1st,p=0.919 GeV
pion rejection efficiency
electron cut efficiency
Pion rejector efficiency
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.88
0.86
0.84
0.82
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Cut in the ratio of (L.prl1.e+L.prl2.e)/Etot


LHRS pion rejector efficiency vs Cerenkov summed ADC cut,E=2.253GeV, 1st,p=0.919 GeV
pion rejection efficiency
electron cut efficiency
Pion rejector efficiency
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Cut in the ratio of L.prl1.e/Etot

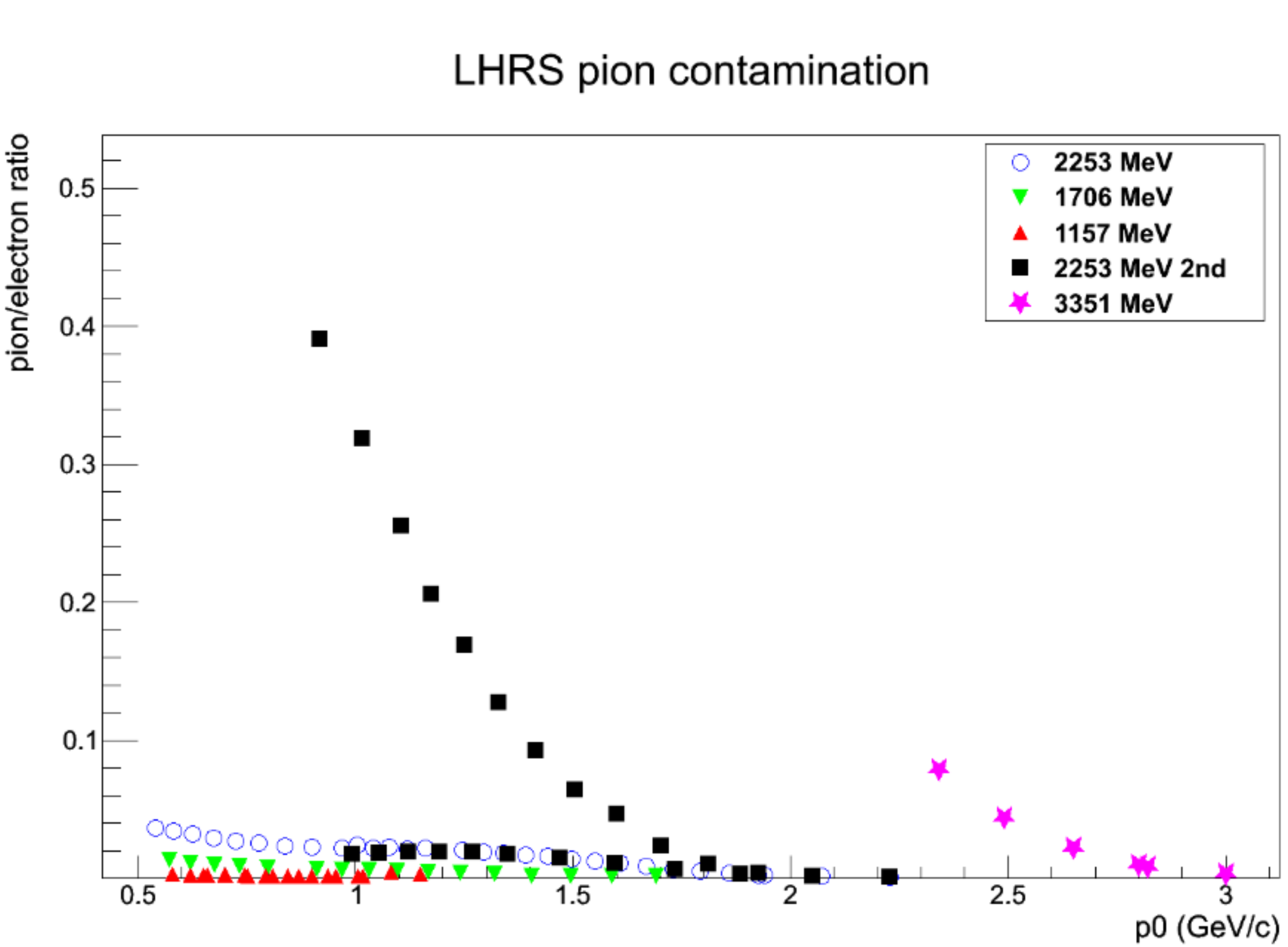

LHRS pion rejector efficiency vs Cerenkov summed ADC cut,E=2.253GeV, 1st,p=0.919 GeV
pion rejection efficiency
electron cut efficiency
Pion rejector efficiency
1
0.95
0.9
0.85
0.8
0.75
0
0.1
0.2
0.3
0.4
0.5
0.6
Cut in the ratio of L.prl1.e/Etot


LHRS Pion Rejector Electron Efficiency
Pion Rejector Electron Efficiency
1
0.98
0.96
0.94
0.92
0.9
0.88
500
1000
1500
2000
2500
3000
Momentum (MeV)
2253 MeV
1706 MeV
1157 MeV
2253 MeV 2nd
3351 MeV

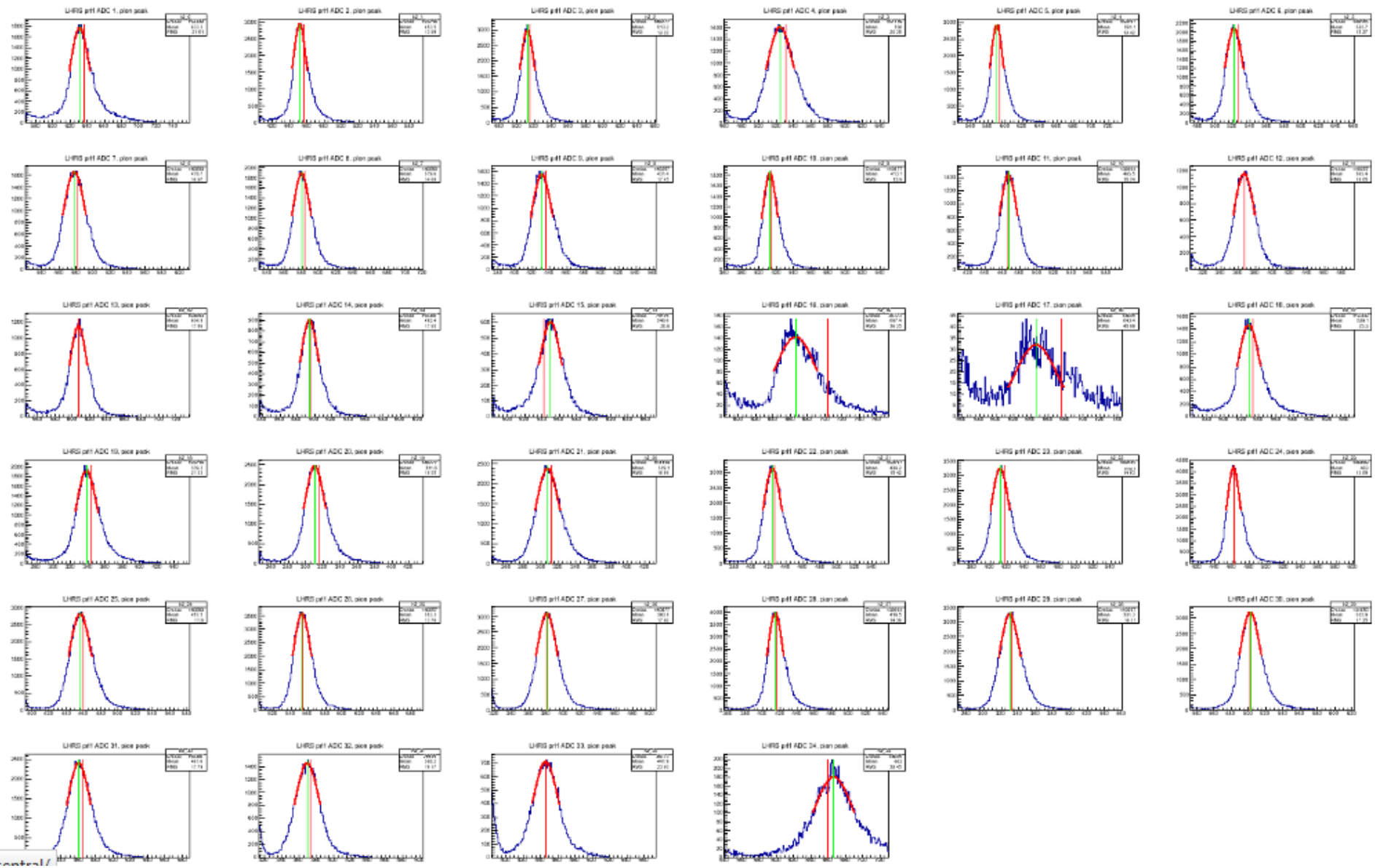

LHRS Pion Rejector Detector Efficiency
Pion Rejector efficiency
1.02
1.01
1
0.99
0.98
0.97
0.96
500
1000
1500
2000
2500
3000
Momentum (MeV)
2253 MeV
1706 MeV
1157 MeV
2253 MeV 2nd
3351 MeV

Pions study

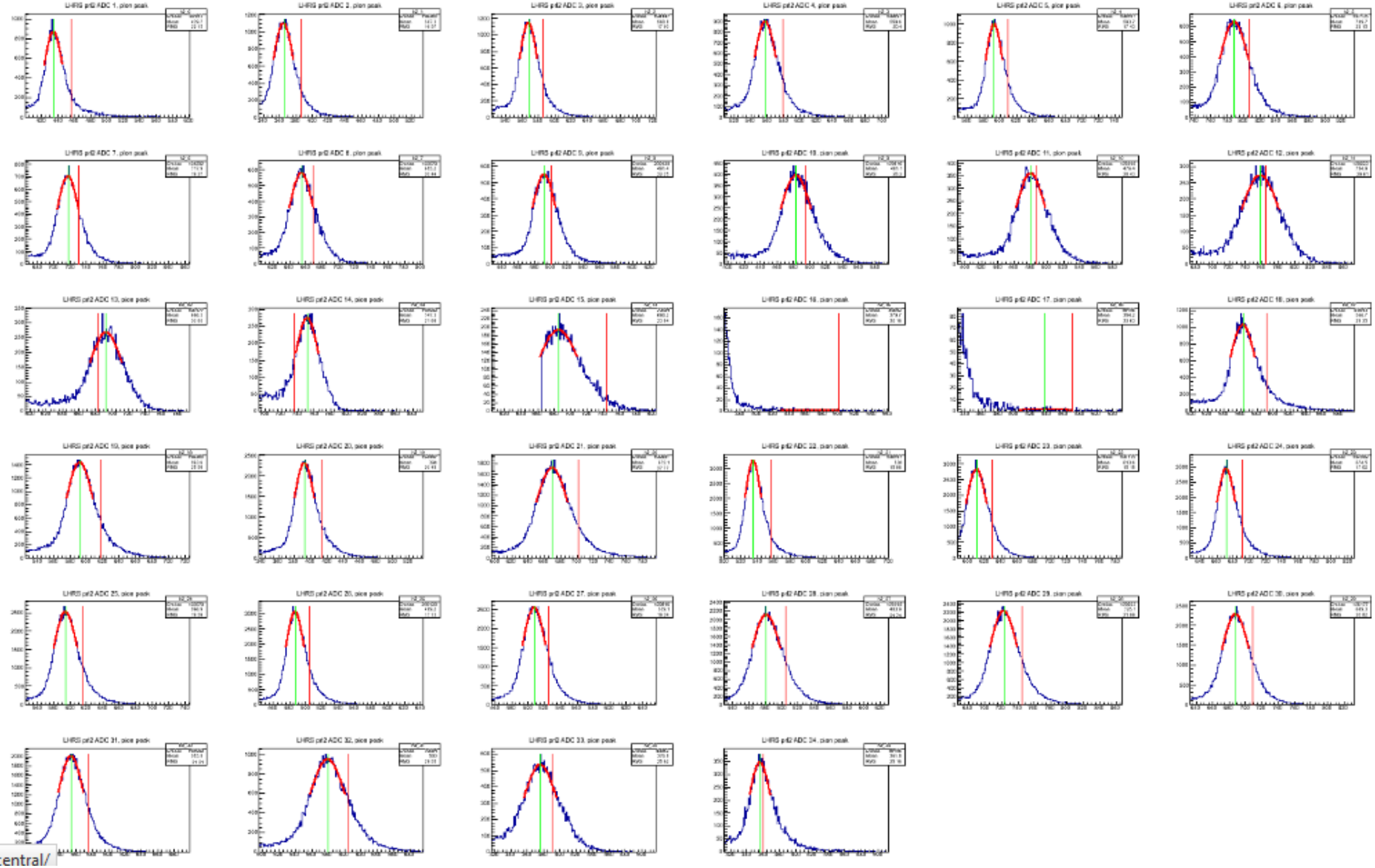
- We see a deviation for Etot/p spectrum
- Check if the coefficient change $\longrightarrow$ deviation?
- Good cut to select pions in prl1 and prl2
- Align pions in each block to 120 ADC Channel

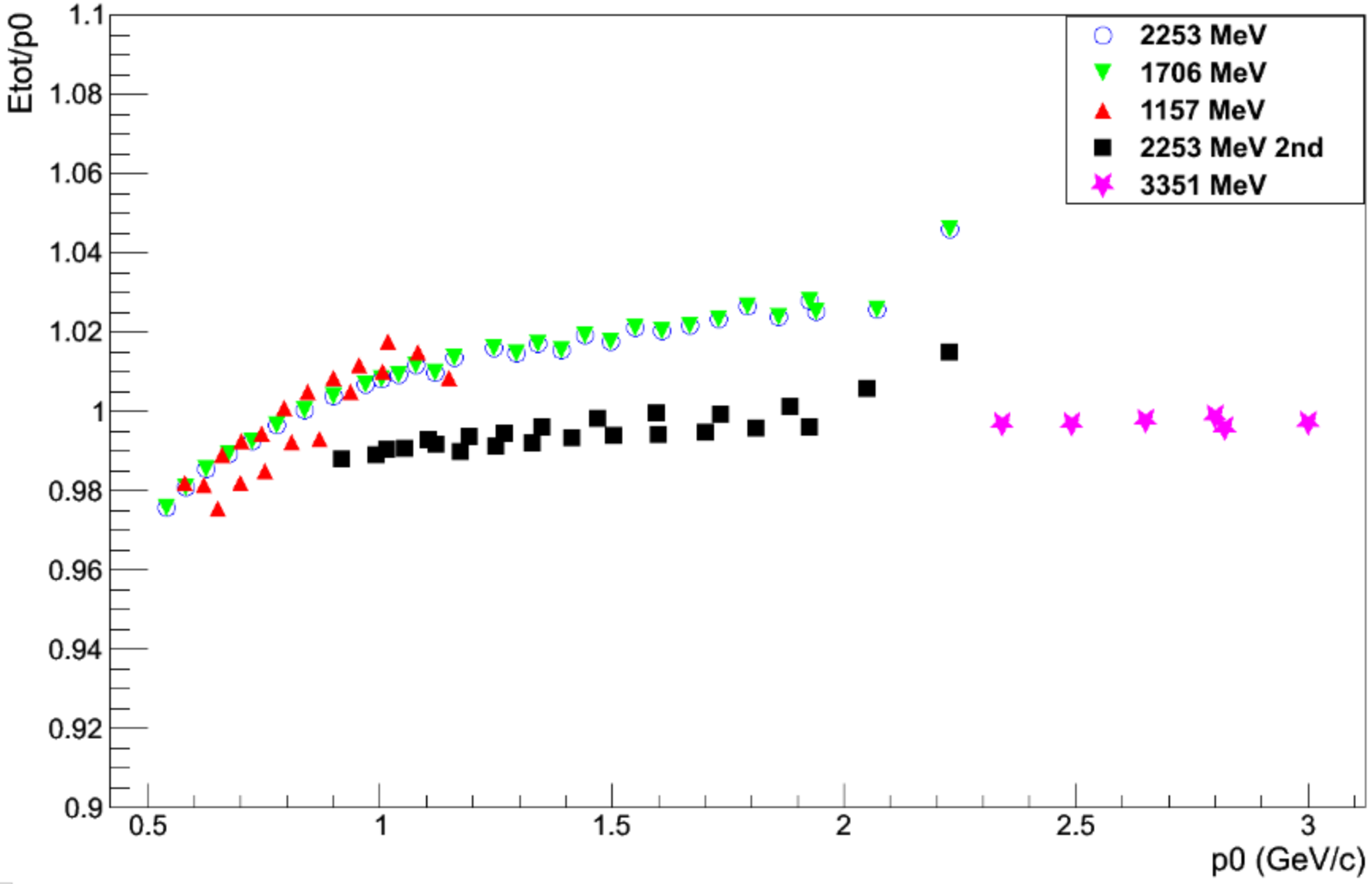

LHRS pion contamination
pion/electron ratio
0.5
0.4
0.3
0.2
0.1
0.5
1
1.5
2
2.5
3
p0 (GeV/c)
2253 MeV
1706 MeV
1157 MeV
2253 MeV 2nd
3351 MeV

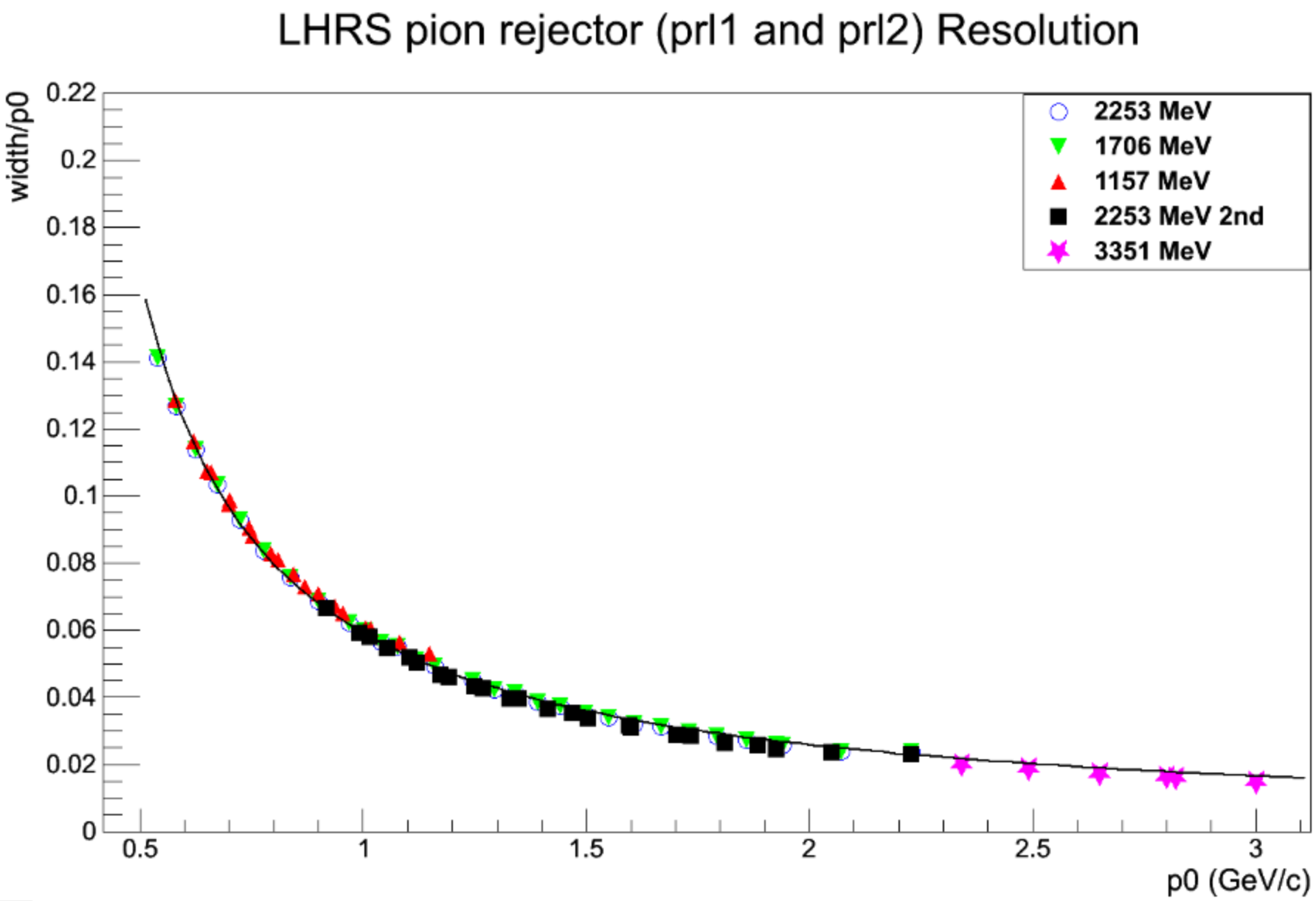
PRL1 1.329 Gev 5T



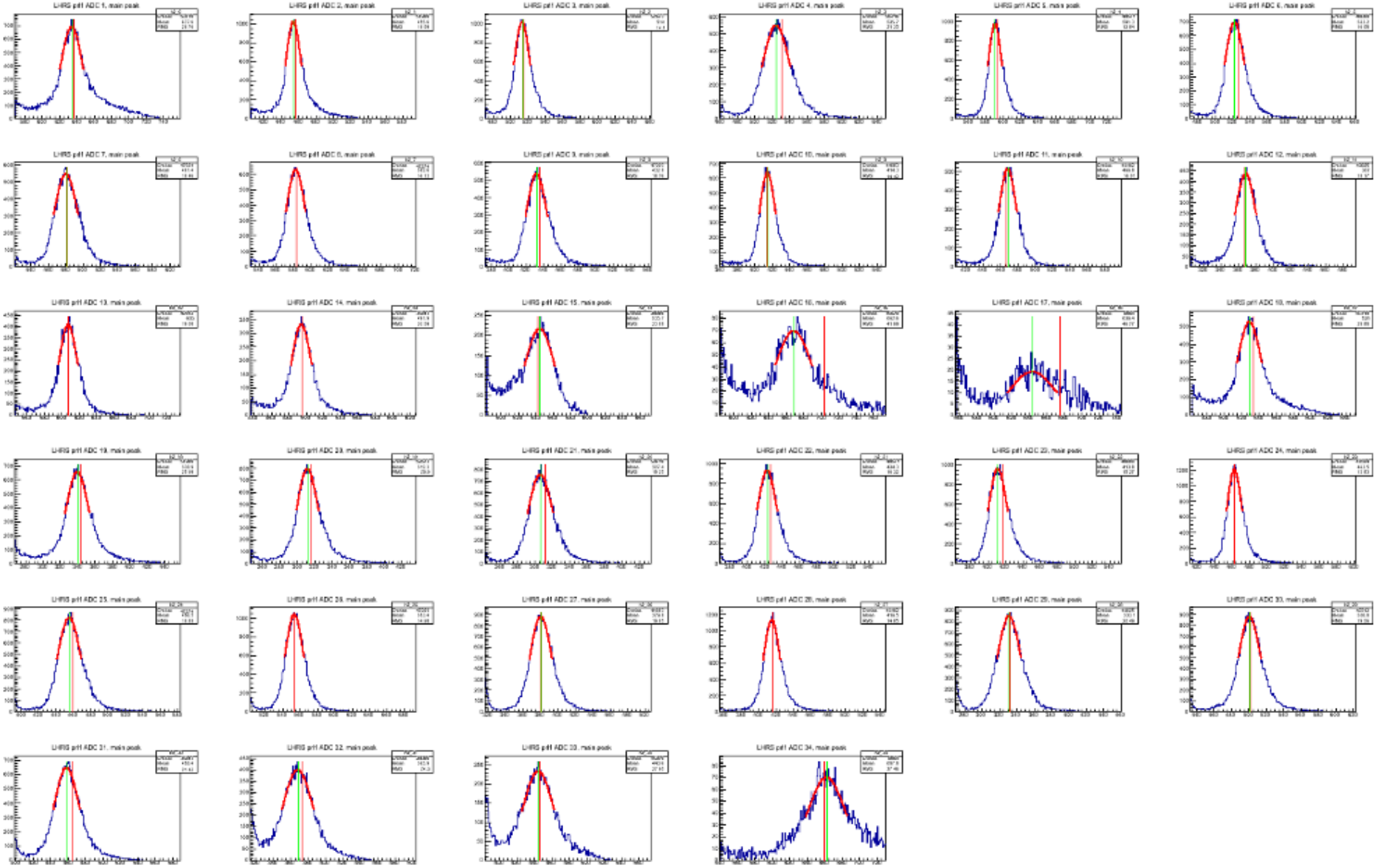
PRL1 1.329 Gev 5T



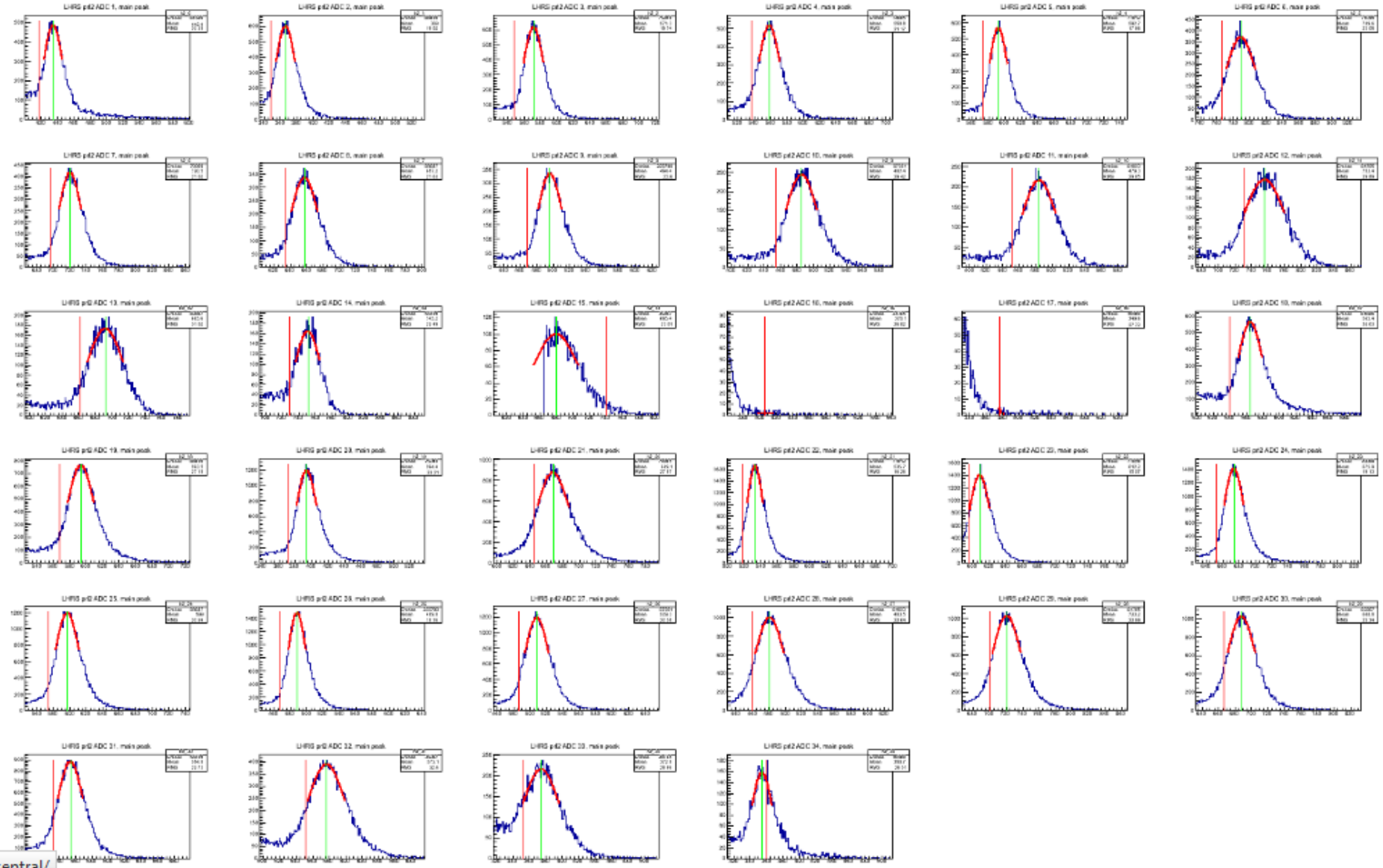

LHRS pion rejector (prl1 and prl2) stability
Etot/p0
p0 (GeV/c)
2253 MeV
1706 MeV
1157 MeV
2253 MeV 2nd
3351 MeV
1.1
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
0.5
1
1.5
2
2.5
3


LHRS pion rejector (prl1 and prl2) Resolution
width/p0
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.5
1
1.5
2
2.5
3
p0 (GeV/c)
2253 MeV
1706 MeV
1157 MeV
2253 MeV 2nd
3351 MeV

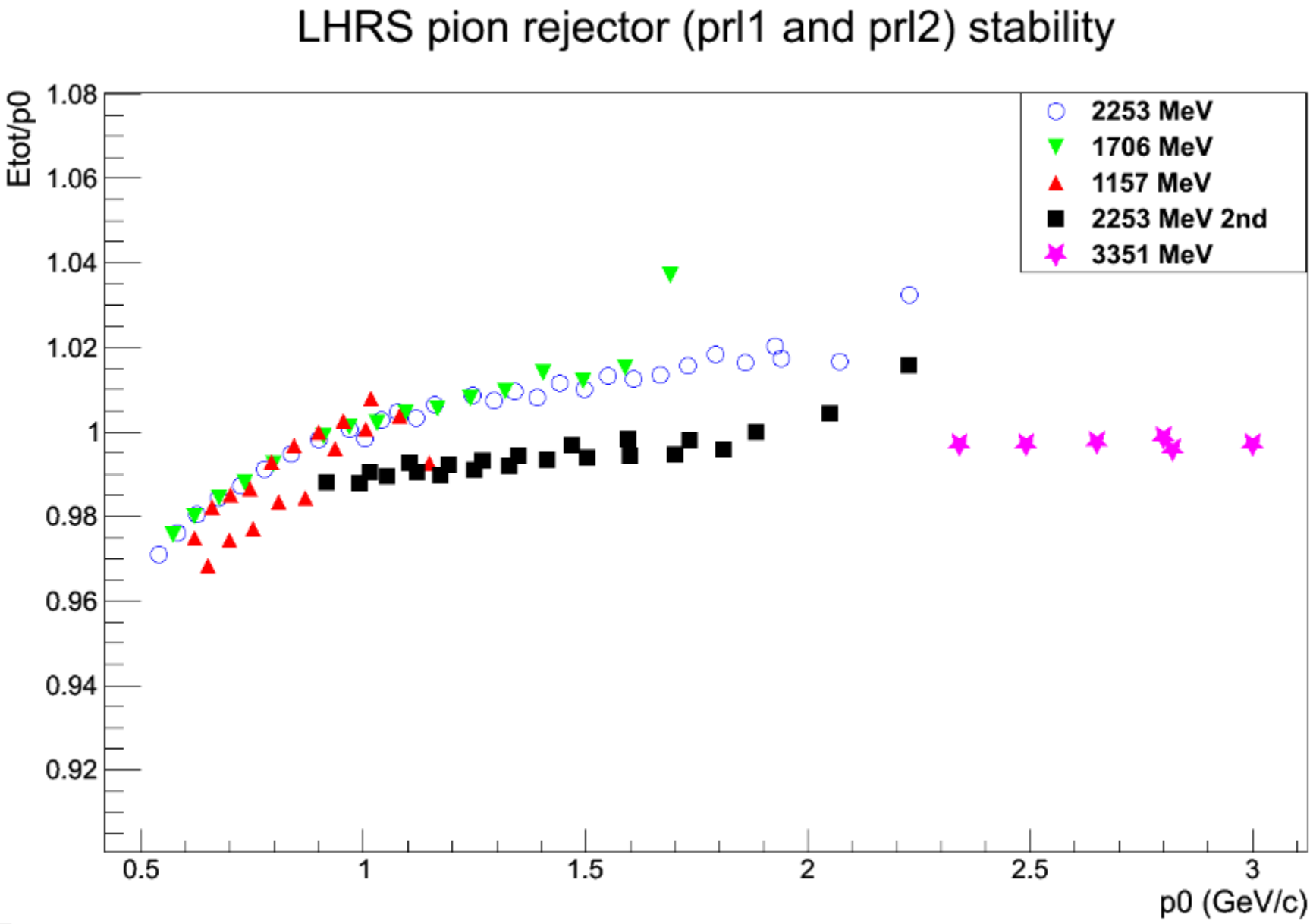
PRL1 1.0028 Gev 2.5T

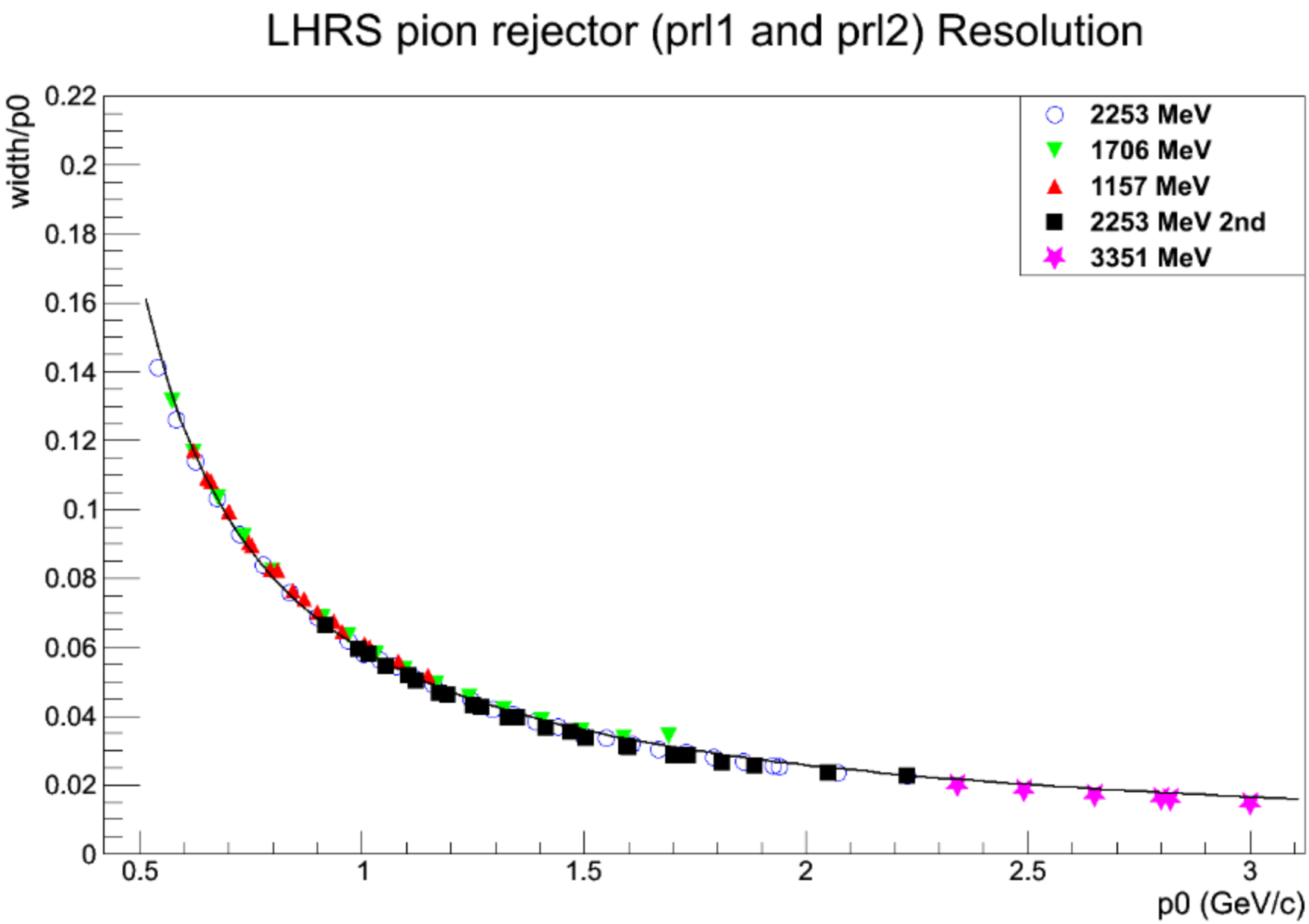


PRL1 1.0028 Gev 2.5T



2.5T tran. 5T long. 5T tran.




LHRS pion rejector (prl1 and prl2) Resolution
width/p0
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.5
1
1.5
2
2.5
3
p0 (GeV/c)
2253 MeV
1706 MeV
1157 MeV
2253 MeV 2nd
3351 MeV

- Conclusion:
- Coefficient did not change too much
- Momentum change?